SPECIES

Using artificial light source as visual enhancement for predation by *Oecophylla* ants in Paren, Kalimpong, West Bengal

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ABSTRACT

Worker ants of *Oecophylla smaragdina* Fab. (Hymenoptera: Formicidae) were found to forage on non-biting midges (Diptera: Chironomidae) and dark-winged fungus gnats (Diptera: Sciaridae) that were attracted to artificial lights at night at Paren in Kalimpong district of West Bengal state, India. These diurnal ants were found to aggressively predate over the dipteran flies using artificial illumination to increase their visibility in order to recognise their prey at night, forming night-time trails between their nest and the artificially illuminated surface. In the present recorded event, artificial light at night has been found to entrain these diurnal ants to extend their foraging activity by desynchronizing their internal clock. This in turn disrupts their typical biological rhythms like foraging behaviour and related decisions, surprisingly resulting in maximising their feeding efficiency as well as the net rate of food energy intake.

Keywords: Artificial light, Nocturnal, *Oecophylla,* Asian weaver ant, Diptera, Foraging, Visual enhancement, Kalimpong, West Bengal.

1. INTRODUCTION

On a global scale, different habitats are affected by artificial light at night (ALAN) disrupting nocturnal and crepuscular animal populations (Owens and Lewis, 2018). Increased light pollution in the past decade is causing artificial glow of the night sky; Kyba et al., (2023) showed an increase in average night sky brightness by 9.6% per year from 2011 to 2022, using data from citizen scientists. Along with astronomical light pollution which affects nocturnal animals that follow astronomical cues on a wider scale, 'ecological light pollution' caused by point sources of different artificial lights in the form of outdoor, street and garden lamps interfere at a much local and finer habitat scale (Longcore and Rich, 2004; Owens and Lewis, 2018) – both affecting intensely the ecophysiological demands of nocturnal animal species that are specially adapted to deal with low-light conditions. Unique adaptive mechanisms exist among such animals to survive at night by heightening their sensory systems, particularly their vision and audition (Bernard, 2004; Cronin et al., 2014).

Out of the global 60% of nocturnal invertebrates (Hölker et al., 2010), insects form a major share. Several authors reported the effect of ALAN on 'temporal disorientation' in such nocturnal animals including the insects, that desynchronize their internal clock – thereby disrupting their typical biological rhythms like foraging, migration, mate search etc. and even retraining them to respond differently in the artificial environment (Saunders, 2012; Numata et al., 2015). Other potential effects of ALAN on insect populations involve spatial disorientation, attraction, desensitization and recognition (Owens and Lewis, 2018). Such a unique event of visual enhancement for predation by *Oecophylla* ants using artificial light at night in Paren, Kalimpong, West Bengal is reported in the present article.

2. MATERIALS AND METHODS

Many tiny flying insects as well as ants were recorded at night on a well-lit surface under the roof of an open dining cottage, set amidst a garden in Paren during 4-6 November, 2017. Paren (Lat: 27°05'33"N; Long: 88°51'23"E) is a small forest village in the western Dooars, situated at an altitude of 1251 mts on the Todey hill of Jhalon, under Gorubathan subdivision in Kalimpong district, West Bengal. White LED lamps (Cool White in colour) were the sole source of artificial light in the cottage and all observations were made under this light source from 5.00 pm to 7.00 pm, during which the required instances were photographed using Nikon D80 and Tamron 90 mm f 2.8 macro lens.

3. RESULTS AND DISCUSSION

Many tiny flying insects, mostly the non-biting midges (Diptera: Chironomidae) and some dark-winged fungus gnats (Diptera: Sciaridae) were found to settle down on the artificially illuminated surface at night (Figure 1). These insects were found to be randomly foraged by the worker individuals of Asian Weaver Ants, *Oecophylla smaragdina* Fabricius (Hymenoptera: Formicidae: Formicinae). These tropical arboreal ants are known to show aggressive predatory behaviour (Narendra and Kumar, 2006), with no exception in the present case where artificial illumination helped these ants with increased visibility so as to recognise their prey. Individual worker ants were observed with open mandibles (with serrated edges on their inner margins) searching erratically for their dipteran prey, with some having the prey in their grips and some others tearing apart the captured ones among them (Figure 1).

The dipteran flies were all attracted through positive phototaxis to the artificial light – a common phenomenon shown by these groups of insects. Whereas, the ants seem to be entrained in the artificial environment, as they were found to gather in mass at every possible place where the dipteran flies settled under the artificial light source. No individuals of the predator or prey in the present case were recorded in the studied site during the day or dusk. Switching to artificial light after dark attracted the flies first, followed by the ants after a while (10-15 minutes). The arboreal nests were constructed near the dining cottage on an adjacent tree, where defined daytime trails were observed for these ants. Night-time trails were also formed between the nest and the described food source, with outgoing and returning workers meeting and touching each other. However, unlike the more defined day-time trails, these night-time trails were not much defined and found to change with the patchy distribution of prey on the artificially illuminated surface – yielding different rates of return for time and energy spent harvesting on the same.

A common ant species in tropical gardens and wooded areas of urban areas of Asia (India to Australia), *O. smaragdina* is a true arboreal species and a dominant one in moist deciduous and evergreen forests like the ones found in Paren and its vicinity, with their colonies extending over a large area involving more than one nest enclosure or one tree (Narendra and Kumar, 2006). In the present case, ALAN has been found to entrain these diurnal ants to extend their foraging activity which in turn proved beneficial to the predatory ants by maximising their feeding efficiency and net rate of food energy intake. However, the overall impact of increased use of ALAN disrupts the ecosystem in many ways, interfering with and altering the biological rhythms of animal species responding to the spectral emission and intensity of the operating ALAN source in the area (Gaston et al., 2015).

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NIL

Author's contributions

Soumyajit Chowdhury contributed solely to the preparation of the entire manuscript, including data collection and photographs, as well as the behavioural notes related to the unique phenomenon of entrainment of *Oecophylla* foraging under artificial luminance.

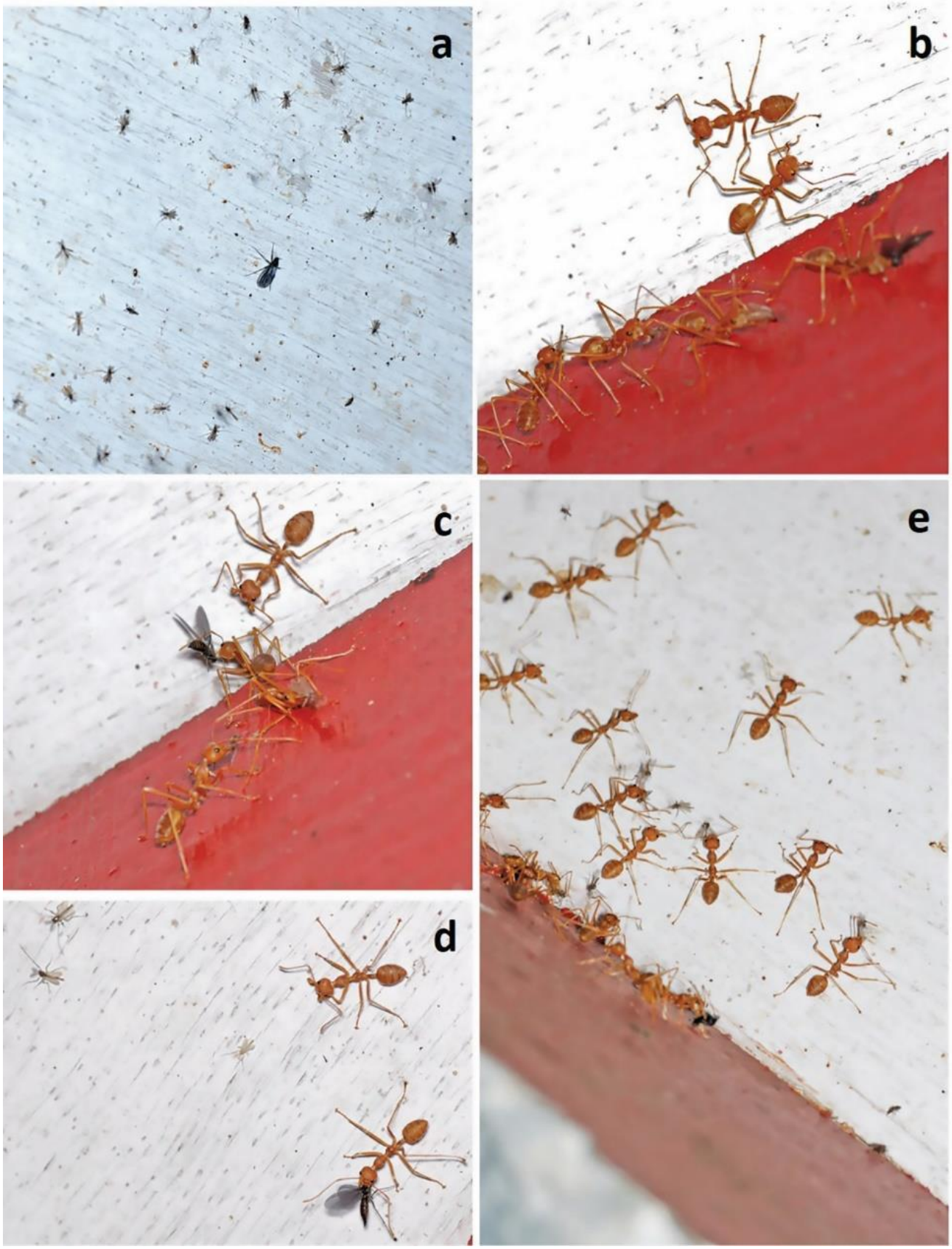

Figure 1 Nocturnal foraging by *Oecophylla smaragdina* under artificial illuminance in Paren, Kalimpong. a) Chironomid and sciarid dipteran flies attracted to artificial light; b) Erratic searching of prey by worker ants with open mandibles; c) & d) Worker ants with prey captured between mandibles; e) Mass aggregation of worker ants in search of prey

Informed consent

Not applicable.

Ethical approval

The ethical guidelines are followed in the study for species observation & identification.

Conflicts of interests

The authors declare that there are no conflicts of interests.

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Data and materials availability

All data associated with this study are present in the paper.

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